or more signals to a secondary side **304** receiver. The primary side **302** has driver circuitry **308** for driving one or more primary coil **306**. The primary coil(s) **306** are connected with a network **310** of one or more selectable capacitors which may be activated by switch(es), e.g., **312**, such that the frequency and Q of the primary coil(s) **306** can be changed dynamically. By manipulating the switch(es), e.g., **312** and changing the effective configuration of the capacitor network **310**, the resonant qualities of the coils may be changed based on a sense of the data integrity, coupling coefficient, or other system parameter detected by the primary side driver circuitry **308**. This system **300** may be implemented using multiple coil(s) **306** having one or more alternative capacitor networks **310** for the dynamic implementation of combinations designed to match operational requirements. An additional feature of the invention includes the capability of driving two or more coils/resonant capacitors in parallel. Each coil/resonant capacitor setup can be used to provide a different filter frequency. This feature may be implemented on either, or both of, the primary side and the secondary side

[0025] One or both sides (primary and secondary) of systems implementing the invention can be built with multiple coils, selectable taps or capacitor networks as shown in and described with respect to FIGS. **1** through **3**, or suitable combinations thereof. The systems of the invention facilitate data transmission, and in some cases power transmission, using multiple coils in configurations through which the system can be adapted to changes in operating conditions, including the presence or absence of a secondary side, or misalignment of primary and secondary coils. Preferably, the systems of the invention have the capability of receiving both data and power on the same lines. This can be done simultaneously or serially. The system can change the transmission frequency when switching between power and data transmission. For example, the system can operate at the resonant frequency of the system for power transmission and change to a different frequency for data transmission. In a system with power and data both present, either the power or the data signal may be used for mode selection, configuration, and/or proximity sensing. When both data and power are transmitted through separate coils of a system, the physical locations of the data and power coils relative to each other can be critical. The relative positions of the coils coupled for transmission of data and power can be changed by selecting coils, and/or taps, and/or capacitor networks as described herein. General advantages may be realized by increasing or decreasing inductive coupling between transmitter and receiver, improving data integrity, or aiding in alignment of transmitting and receiving coils.

[0026] Physical proximity sensing by monitoring the current behavior on the primary coil(s) may be used to optimize overall system behavior. For example, the system can be put into an ultra-low power mode when there is no detection of a secondary coil in suitable proximity suitable for signal transfer. When the system detects the proximity of a secondary coil, then the system can enter into a more active mode such as a signal transfer mode. The system configuration and/or operation can also be changed based on the proximity of one or more secondary coil. For example, if the system uses a periodic ping to search for a receiver, then the ping frequency can be increased when proximity is detected. In some applications this will reduce the time required for the system to come up and complete configuration.

[0027] There are advantages to utilizing inductive multiple coil data and power transmission simultaneously. In a system which transmits both power and data, the power loop can be regulated using communication through the inductive data path. This path has higher bandwidth than other communication techniques such as modulating the power signal. Providing a high speed data path also enables additional functionality. Using the high speed data path for power control permits higher bandwidth and faster response times. Since the coupled coils are physically separated, they can be used to transmit data across an isolation barrier. This can be implemented in several different physical configurations. For example, the primary and secondary coils may be stacked vertically with an isolation barrier between them. The coils may be co-planar, either interleaved or not interleaved. In any implementation, the transmitting and receiving circuitry may be implemented separately or monolithically on a single piece of silicon. Using coils for data transmission is inherently a localized field communication. Consequently, this technology can be used for a variety of secure data transfer needs. These secure data transfer needs include, but are not limited to, payment transactions, personal identification, access control, asset tracking and management, transportation and logistics, animal identification, and inventory systems.

[0028] While the making and using of various exemplary embodiments of the invention are discussed herein, it should be appreciated that the present invention provides inventive concepts which can be embodied in a wide variety of specific contexts. It should be understood that the multiple coil system of invention may be practiced with coupled inductor systems having communications and power transfer functionality, such as in battery chargers, power converters, portable electronics, and the like. For purposes of clarity, detailed descriptions of functions, components, and systems familiar to those skilled in the applicable arts are not included. The methods and apparatus of the invention provide one or more advantages including but not limited to, data transfer capabilities, managed power transfer capabilities, and enhanced energy utilization and conservation attributes. While the invention has been described with reference to certain illustrative embodiments, those described herein are not intended to be construed in a limiting sense. For example, variations or combinations of steps or materials in the embodiments shown and described may be used in particular cases without departure from the invention. Various modifications and combinations of the illustrative embodiments as well as other advantages and embodiments of the invention will be apparent to persons skilled in the arts upon reference to the drawings, description, and claims.

We claim:

1. A system for wireless data transmission comprising:

a plurality of primary coils operably coupled to be driven independently with a signal;

one or more secondary coil positioned in proximity to the primary coils and suitable for receiving the signal inductively; wherein

the signal may be inductively transferred from one or more primary coil to one or more secondary coil.

2. The system for wireless data transmission according to claim **1** wherein a plurality of primary coils are operably coupled with circuitry for sensing secondary coil proximity and for responsively transmitting a signal to detected secondary coils.